



international vehicle communications RoundTable

Michigan Department of Transportation

Proceedings of International Vehicle Communications Summit

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In association with 86th TRB Annual Meeting

The following participants were in attendance:

First	Last	Title	Organization	Email
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Mike	Miles	Deputy Director - Maintenance and Operations	CALTRANS	
Larry	Orcutt	Chief - Division of Research and Innovation	CALTRANS	
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Mr. Leighton James (Welsh Assembly Government, Transport Directorate), who planned to provide the Welsh perspective, was unavoidably detained and unable to attend.

1. Introduction

MDOT Director Kirk Steudle welcomed the participants and expressed his appreciation for the wide attendance from the United States and Europe, including national and state representatives, as well the European Community. Director Steudle recognized the strong vehicle communication programs being carried out in California, and Caltrans' co-sponsorship of the roundtable. The participation and assistance of the USDOT FHWA was also acknowledged.

Director Steudle outlined the objectives of the roundtable, including: (i) the promotion of awareness of vehicle communication initiatives in all countries and regions and (ii) the sharing of information, approaches and lessons learned. Information sharing is particularly important given the large number of technological, economic and societal challenges in gaining significant deployment of vehicle and infrastructure communication. Without a purposeful rate of deployment, supported by articulation of benefits, the full potential of vehicle communication will not be achieved.

Director Steudle observed that the primary driver for vehicle communication is safety, and the potential for crash avoidance. But the benefits of vehicle communication are not restricted to safety: there will be improvements in the efficiency of traffic flow, reductions in vehicle emissions and a lessening of energy demand, all on a scale that cannot be achieved by any other means while maintaining our economies and level of service for mobility. There are also attractive benefits for motorists in terms of travel information and a range of electronic services.

2. Regional Backgrounds

The following account has been supplemented with information from white papers submitted prior to the meeting and from relevant websites, as noted.

2.1 California

Mr. Larry Orcutt, Chief, Division of Research and Innovation, Caltrans added to Director Steudle's welcome, expressing Caltrans' pleasure in co-sponsoring the international roundtable and in joining with MDOT to lead a broader discussion of the deployment of vehicle communication technologies.

California's 2005 VII demonstrations, in conjunction with the San Francisco ITS World Congress, had removed any doubts about the reality of VII. Since that time, the Metropolitan Transportation Commission (MTC) and Caltrans have concentrated on the full deployment of the VII California Bay Area Testbed, with a M\$1.5 program current through early 2008. MTC and Caltrans are now seeking to expand the program through partnership with additional original equipment manufacturers (OEMs), including DaimlerChrysler, VW and BMW. This expanded program will allow the partners to truly demonstrate and evaluate the potential of VII. A successful conclusion to this demonstration may lead to a statewide deployment in accordance with the Governor's California Strategic Growth Plan or serve as a catalyst for a national deployment.

California is involved in the USDOT Cooperative Intersection Collision Avoidance Systems (CICAS) program partnership to develop vehicle-infrastructure cooperative systems that address intersection crash problems related to stop sign violations, traffic signal violations, stop sign movements and unprotected signalized left turn movements. Caltrans has a partnership with the University of California Partners for Advanced Transit and Highways (PATH) Program to develop the CICAS-Signalized Left Turn Assist (CICAS-SLTA): a system that uses a dynamic message sign (DMS) or in-vehicle sign to tell drivers when it is unsafe to make an unprotected left turn at a signalized intersection.

California is also developing corridor mobility programs utilizing WiFi, cellular, satellite navigation and real-time traffic information.

Discussion included new vendors and standards for DSRC radios (plans for approximately 40 units installed) and consideration of expansion to up to 4000 intersections in Los Angeles.

2.2 Austria

Mr. Reinhard Pfliegl presented the Austrian perspective. The motivation for vehicle communication technology in Austria is the need to maximize the safety contribution of both vehicle and infrastructure. While the automotive industry made significant progress in the nineties with new technology for safety, we are now seeing limitations in terms of cost, liability and legal restrictions. Therefore there is a need for a more intensive approach to the intelligent roadway, and to balancing the technology on the vehicle and infrastructure sides of the highway system.

The objectives are first, safety and second, greater through-put. This requires a more active role for road management and greater co-operation between the necessary domains and partners. It is intended to utilize general-purpose equipment installed in the roadside by adding services in the future, using the same units. The key motivation is a co-operative system for safety and efficiency. In order to bring about real change, it is necessary to create systems which act and avoid, rather than react.

Austria is involved in the European Commission (EC) Co-operative Networks for Intelligent Road Safety (COOPERS) project, which concentrates on the development of Infrastructure to Vehicle (I2V) data communication for efficient transport management at very dense traffic flows on motorways.

The software tools for data acquisition, data fusion, calculation of the current network status and distribution of this information to the specific road segments need to be developed and are a central part of the work.

The proof of concept will be tested on three European test sites, with the involvement of 5 motorway operators. These test sites are representative for the different traffic conditions on European motorways. The first is a long distance corridor between Germany, Austria and Italy, the second an interurban motorway in a densely populated area of the Netherlands and Belgium, and therefore affected by constantly high traffic volumes, and the third near to Berlin (Germany) in an urban environment.

The motorways selected for the test sites are among the busiest in Europe and have reached capacity. There is strong interest in the additional capacity which may be achieved with vehicle communication, and in the provision of prior warning of impending traffic slow-downs.

The COOPERS project is being coordinated by AustriaTech, a technology development agency of the Austrian Ministry for Transport, Innovation and Technology. AustriaTech's mission is to foster telematic deployment in the transport system for a safer, more efficient and environmentally friendly management of transport flows.

Discussion centered on the feasibility of recommending shorter headways, and who is responsible for the accuracy of the information to be transmitted. It is intended that speed instructions will be mandatory and that the motorway operator will bear responsibility for the correctness of instructions and information transmitted. These motorway operators already have roadside equipment for collecting tolls from motorway users.

2.3 Sweden

Mr. Ingemar Skogo presented the Swedish perspective. Sweden is pleased to be signing a Memorandum of Understanding (MOU) with Michigan concerning vehicle communication research and development. (This MOU was subsequently signed).

While ITS and mobile communications have been used in Sweden for some years, the big question is implementation in real life. In fact, the theme of the 2009 ITS World Congress in Stockholm will be "ITS in daily life".

Sweden has a vision zero for safety and this vision needs to be fully supported by ITS. While many stakeholders agree on the goal, the steps to achieving the goal are not obvious.

The mobile communication systems for ITS applications and services already exist. The question is how to maintain open systems while transitioning from the "laboratory" to real life. This process will be aided by push/pull of the service providers and markets, rather than driven by regulation. For example, the procurement of school buses will include mobile communication services. Sweden is also utilizing speed alerts, with 5000 units deployed and positive results.

The human aspect is recognized as a critical success factor and the Human Machine Interface (HMI) is a key enabler of ITS into real, everyday life. The current concern about driver distraction with mobile phones illustrates how important it is to handle the HMI issue well.

Sweden is investing in vehicle communication deployment via the Intelligent Vehicle Safety Systems (IVSS) joint venture by public-sector agencies, private-sector companies and industry organizations, to stimulate research and development for the road safety of the future. Programs underway include Cooperative Vehicle-Infrastructure Systems (CVIS) and Increasing Vehicular Safety in Commercial Vehicles with Improved Attributes and Advanced Driver Assistance Systems (SOLVI).

There was positive discussion concerning the Swedish business model where the government will take a positive role to develop market opportunities, to the point that the market will take over. Significant discussion centered on required means of proving safety benefits. At the engineering level of a research and development program, no specific proof is needed, but wide-spread deployment would require a certain standard of proof. While investments in mobile communications systems need to be economically wise, it is usually not necessary to prove a positive benefit/cost ratio. However, field operational tests offer the potential for more extensive evaluation on real roads with real drivers; such

testing provides a statistically sound basis for evaluating safety benefits. This was considered to be a crucial common issue for all participants, and a key area for international co-operation.

Further discussion highlighted the huge opportunity for international co-operation and sharing of compatible data. Given the limited number of test beds, it will be necessary to share data in order to produce results with statistical validity. We also need root cause analysis, and this data is very hard to share without a common set of protocols and definitions. The HMI issue, and consequent effect on driver behavior, was raised as a prime example of the need for shared data and analyses.

Considering the countries and regions represented, and the diversity of road and traffic conditions and the diversity of VII applications, it will be necessary to define some common data formatting methodologies if we are to create a larger base of knowledge.

2.4 American Association of State Highway and Transportation Officials (AASHTO)

Mr. Jim Wright presented the AASHTO perspective. AASHTO is active in sponsoring national VII policy activities and in supporting the national VII proof of concept (POC) program. Co-ordination of VII activities is essential. There is a group of lead states (including California, Michigan, Florida and Minnesota) and other states are watching carefully. AASHTO has been involved in international scanning tours and is promoting a tour at the ITS World Congress in Beijing, as well as the AASHTO International Day immediately prior to the Congress.

2.5 Michigan

Mr. Greg Krueger presented the Michigan perspective and announced the release of the Michigan VII Update (Vol. 1 No. 1 January – March 2007) as well as the ITS-Michigan Newsletter (December 2006).

The Michigan VII Strategic and Business Plan was released in January 2007 and sets out a comprehensive vision for VII to contribute to all aspects of high quality integrated transportation services; namely, addressing the needs of MDOT customers and partners through improved safety, traffic management, and asset management.

A key element of the strategy is the Michigan VII Test Bed which has been created around an advance partnership with the auto industry and other members of the private sector. Examples of this partnership include 3000 DaimlerChrysler vehicles utilizing WiFi and the proof of concept (POC) vehicles developed by the VII Consortium (VII-C). The Test Bed has been purposefully developed to maximize the involvement of the auto industry and associated industries involved in advanced vehicle technologies and smart highways.

An exciting phase has just begun with the VII Data Use Analysis and Processing (DUAP) project which focuses on backroom data use. This data will change the way any operating and maintenance agency does business. The first phase of the project will focus on real-time applications of sensed data such as traffic information, performance-measure calculations, congestion mitigation, and air-quality applications. The university of Michigan Transportation Research Institute (UMTRI) is playing a key role in evaluating VII data use.

Discussion centered on the need for data sharing and opportunities for the widest possible dissemination of VII data and findings. The DUAP will commence in the first quarter of 2007 and UMTRI will document activities and progress. To further aid co-operation and dissemination, the DUAP Steering Committee has wide representation, including international involvement. MDOT is committed to sustainable ordering and sharing of VII information.

2.6 European Commission (EC)

Mr. Fabrizio Minarini presented the EC perspective. Among the 27 EC Member States there are many domains, but transportation is a key issue and there is an important initiative in communication technology for transport, with objectives of safety, efficiency and economic development.

EC members have already experienced the problems associated with incompatible motorway tolling systems, and it is imperative that a common system is developed for vehicle communication technology.

Under the eSafety Initiative, the EC is working with industry to accelerate the deployment of integrated safety systems which use Information and Communication Technologies (ICT) to increase road safety. The aim is to bring research results to the market much faster. Legislation of such safety systems is extremely slow and risks the entrenchment of obsolete technology. Therefore systems with strong market appeal are required, and the EC will work to accelerate the development of the market.

In the past, advanced safety systems have usually been based in the vehicle, and sometimes in the infrastructure. However, much greater performance is required of these systems and on-board systems cannot tackle all situations. The EC is therefore investing in co-operative systems, via three key projects being carried out through the EC Directorate-General Information Society and Media:

- Co-operative Networks for Intelligent Road Safety (COOPERS)
- SAFESPOT
- Co-operative Vehicle Infrastructure Systems (CVIS)

COOPERS is funded by the EC under the IST Programme, and is being managed by AustriaTech. Following a series of telematics projects, COOPERS concentrates on the development of Infrastructure to Vehicle (I2V) data communication for efficient transport management at very dense traffic flows on motorways.

SAFESPOT is an integrated research project co-funded by the European Commission Information Society Technologies among the initiatives of the 6th Framework Program. The objective is to understand how intelligent vehicles and intelligent roads can cooperate to produce a breakthrough for road safety. The aim is to develop a Safety Margin Assistant that detects in advance potentially dangerous situations; the Safety Margin Assistant will be an Intelligent Co-operative System based on Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) communication.

CVIS is coordinated by ERTICO and aims to design, develop and test the technologies needed to allow cars to communicate and network directly with the roadside infrastructure. With CVIS, drivers can influence the traffic control system directly and get individual guidance on the quickest route to their destination. Speed limits and other road sign information, as well as warnings of approaching emergency vehicles and similar urgent messages will be sent wirelessly to the vehicle and displayed for the driver.

To validate the project results, CVIS technologies and applications will be tested at one or more test sites in seven European countries: France, Germany, Italy, Netherlands/Belgium, Sweden and the UK.

The EC has asked these three projects – COOPERS, SAFESPOT AND CVIS - to work together on a common architecture; a workshop was recently held with 120 participants. However, there are a number of parallel initiatives and more structure and joint action are needed. Not only is there a need for data exchange, but also substantive exchange on methodology. The need is urgent and calls for co-operative work involving a range of experts. This will need to be funded and concerted political engagement will be needed to secure more support.

Further discussion centered on the need for results, and this may require the formation of technical working groups, in addition to the international roundtable, which is more policy-oriented.

2.7 US Department of Transportation

The USDOT perspective was presented by Mr. Brian Cronin.

The Department has three major ITS research initiatives that focus on vehicle communications: Integrated Vehicle Based Safety Systems (IVBSS), Cooperative Intersection Collision Avoidance Systems (CICAS), and Vehicle Infrastructure Integration (VII). The three initiatives focus on innovative combinations of technologies to solve critical transportation problems related to safety and mobility. Each is designed as a set of partnerships that include the Department's modal administrations, private sector organizations pursuing similar research, State and local transportation agencies, professional associations, and other public sector interests.

(i) Integrated Vehicle Based Safety Systems (IVBSS)

Sponsored by the National Highway Traffic Safety Administration (NHTSA) and the Federal Motor Carrier Safety Administration (FMCSA), the IVBSS Initiative integrates several driver assist systems and is expected to reduce driver workload and driver reaction time. The integration of several crash warning systems is expected to improve overall system performance, increase safety, reduce system cost, improve consumer and fleet operator acceptance, and enhance product marketability. The IVBSS program is developing performance specifications and is measuring the real world benefits of integrated technologies for:

- Forward-Looking Collision Warning
- Lane-Departure Warning
- Lane-Change Collision Warning

The first phase will develop the collision avoidance system and the second phase will involve a Field Operational Test to evaluate effects on driver behavior. Program partners include University of Michigan Transportation Research Institute (UMTRI), Visteon Corporation, Eaton Corporation, Honda America, International Trucks, Assistware, Battelle Science and Technology International, and Michigan DOT.

(ii) Cooperative Intersection Collision Avoidance Systems (CICAS)

CICAS is a critical component of the ITS program's move toward preventing crashes through the development and deployment of active safety systems. CICAS utilizes vehicle-to-infrastructure communication and specifically addresses crossing-path intersection crashes. The CICAS Initiative is combining technologies into several types of systems:

- Signal and Stop Sign Violation Warning System (CICAS-V):
- Gap Assist Systems (CICAS-Gap)
- Stop Sign Assist System
- Signalized Left Turn Assist System

The development of the CICAS systems is a cooperative research process being performed by the ITS Joint Program Office, the National Highway Traffic Safety Administration (NHTSA), and the Federal Highway Administration (FHWA), the automotive companies (through the Crash Avoidance Metrics Partnership (CAMP)), State and local transportation agencies, other related industry groups such as, signal vendors and systems integrators, and university research centers.

(iii) Vehicle Infrastructure Integration (VII)

VII is an information infrastructure that utilizes the most advanced communications technologies to exchange real-time information between the roadside and vehicles. Communications equipment is placed both on the infrastructure and within the vehicle. Example uses of data transmitted from vehicle to vehicle and between vehicles and the roadside include:

Safety

- Warn drivers of unsafe conditions or imminent collisions.
- Warn drivers if they are about to run off the road or speed around a curve too fast.

Mobility

- Inform system operators about real-time congestion, weather conditions, and incidents.
- Provide operators with information on corridor capacity for real-time management, planning, and provision of corridor-wide advisories to drivers.
- Adjust signals to optimize traffic conditions.
- Inform drivers on real-time traffic conditions.

The VII Initiative attempts to answer the fundamental question of whether it is technically feasible, economically viable, and socially acceptable to coordinate the deployment of a nationwide communication system on the road infrastructure and in all vehicles sold in the U.S.

The ITS Program is working with the industry to develop specific applications that will serve as a core suite and that will be available during the initial deployment of VII. Applications will be integrated into

the VII end-to-end system to demonstrate proof-of-concept (POC) using a development test environment. The suite of initial applications is:

- Emergency electronic brake lights
- Curve speed warnings
- Traffic signal and stop sign violation warnings
- In-vehicle signing
- Traffic information
- Off-board navigation
- Electronic payments (tolls, gasoline, and parking)
- Road and weather conditions
- Traffic signal optimization
- Traffic management and control

These applications will enable a test of the functionality of the VII system, and provide results that will form the basis for a deployment decision. Upon completion of the proof-of-concept testing, and with a joint public-private decision to deploy the VII system, additional application development work will take place in preparation for an initial national roll-out.

A coordinated deployment by industry and government will provide drivers with the highest benefits from each VII application. This requires a commitment from the automotive industry to produce vehicles with VII applications, and from public sector transportation agencies to deploy and maintain the VII on major U.S. roadways.

To ensure that stakeholder involvement is seamless, the Department has convened a VII Coalition comprised of auto manufacturers, American Association of State Highway and Transportation Officials (AASHTO), ten State DOTs, and other key stakeholder groups to complete the work that is essential to the deployment decision. The coalition has formed an Executive Leadership Team and a Working Group. This team is composed of senior officials of all Coalition member organizations and is responsible for strategic leadership and policy guidance. The Working Group is responsible for carrying out the research and analysis necessary to determine the feasibility and approach for deploying VII.

2.8 ITS America

Ms. Suzanne Murtha presented the ITS America perspective. ITS America is supporting the national VII working group and plays a key role in representing its member organizations, including a wide range of independent players who are not otherwise represented.

ITS America has provided active support by carrying out a series of VII demonstrations throughout the US, aimed at industry as well as the general public. This VII roadshow has proven extremely successful. ITS America plans to continue the roadshow, culminating in a VII City in Manhattan on the occasion of the 2008 ITS World Congress in New York City.

Discussion centered on the privacy issue, and the fact that this has proven to be surprisingly muted during ITS America's extensive VII outreach activities.

2.10 Asia (Bishop Consulting)

Mr. Dick Bishop presented a brief perspective of initiatives for vehicle-highway co-operation in Japan, China, Korea and Australia. There are several active programs, including the Smartway program in Japan. Smartway is a public-private partnership co-ordinated by the Ministry of Land, Infrastructure and Transport. This program has initially focused on vehicle-to-infrastructure communication and is introducing vehicle-to-vehicle communication as a further stage.

The early stages of Smartway concentrated on the deployment of roadside communications, and the provision of information services along roadways, at rest areas and at public parking areas. Further types of information for assisting safe driving are being introduced in 2007, including "congestion ahead" advisories and "merging ahead" advisories. Further development will include information on forward obstacles.

3. Discussion and Conclusion

The roundtable brought forth a collective interest in the ordering and sharing of vehicle communication data and methodology. Strong views were expressed about the need for sharing information and data, and the dissemination of best practices. It became clear that this need is generated by certain circumstances which are strikingly common to all countries and regions:

- Worldwide, there will be a limited number of test beds and field operational tests
- There is a diversity of vehicle communication initiatives and of the traffic environments in which they are being trialed
- Reliable and credible information on the benefits of large-scale deployment of vehicle communication initiatives is needed, sooner rather than later
- Information is needed regarding safety benefits and traffic efficiency gains
- Public-private partnerships are needed to arrive at the point of market attractiveness needed to bring about wide deployment.

The roundtable identified a common need to work together and discussed a structured approach including:

- Preparation of a co-operative state-of-the-art report on data and methodology to support vehicle communication initiatives
- Scanning of best practices
- Formulating and conducting a co-operative research project to apply best practice methodologies to selected vehicle communication use cases; consideration was given to the inclusion of one safety use case and one traffic efficiency use case.

It was agreed that the roundtable participants will come together for further discussion, and potential opportunities exist at the ITS America Meeting in June 2007, and at the ITS World Congress in October 2007. It was suggested that videoconference and teleconference facilities be made available for future meetings.

The Michigan delegation agreed to prepare an outline (notional table of contents) for a co-operative state-of-the-art report on data and methodology to support vehicle communication initiatives. This outline will be circulated to all roundtable participants for comment and discussion prior to our next meeting.

As Director Steudle was unable to remain to the end of the meeting, Mr. Greg Krueger thanked all participants and expressed the hope that the roundtable would lead to an on-going forum in the field of vehicle communication initiatives and to active co-operation regarding data use and methodology. Mr. Krueger also acknowledged Caltrans' role in supporting the international roundtable.

Mr. Larry Orcutt expressed Caltrans' appreciation for the valuable discussion and suggested that California would be interested to work with Michigan and others to prepare a roadmap for VII development and deployment initiatives.

4. Action Items

- (i) Minutes of international roundtable to be prepared and circulated (P. Sweatman)
- (ii) Draft outline (notional table of contents) for a co-operative state-of-the-art report on data and methodology to be prepared and circulated (P. Sweatman and G. Krueger)
- (iii) Draft roadmap of VII development and deployment initiatives to be developed (G. Krueger and L. Orcutt)
- (iv) Notice and agenda for next roundtable meeting (G. Krueger and L. Orcutt)